Furthering Higher Education Possibilities through Massive Open Online Courses

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Chapter 7
Learning Objects in MOOC:
Good Practice for Learning Objects

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ABSTRACT

Massive Online Open Courses (MOOC) are still in their infancy on the surface they look like the necessary silver bullet to provide alternate pathways to education. However, when completion rates and retention figures were published in 2013 the whole concept of the MOOC came under criticism. This criticism has grown largely as a result of the uncertainty and lack of detail about what a MOOC actually is; yet there appears to be a global drive behind MOOC. The ubiquitous presence of technology may be seen as a change agent and there is arguably sufficient demand for a new delivery model to provide education to a modern market. MOOC could fulfil this requirement for an alternate model. Central to the success of MOOC is the availability of high quality learning objects or Open Educational resources (OERs). This chapter provides a background to learning objects and MOOC and looks at good practices in the design, development and management of learning objects in MOOC.

BACKGROUND TO LEARNING OBJECTS AND MOOC

Technology is a change agent in education. Mobile devices have revolutionised education and MOOC have developed as the physical learning environment has changed dramatically over the last decade. Cornier and Alexander coined the term MOOC in 2008 and the definition of MOOC is constantly evolving. Arguably without OERs we could not have seen such an explosion of MOOC. Sir John Daniel has served as President and CEO of the Commonwealth of Learning from 2004 to 2012 and is recognised by many as a key contributor to the literature for open learning. Daniel and Uvalić-Trumbić (2014) identify learning objects, specifically OERs, as the "long fuse that detonated the MOOC explosion". Quite simply without learning objects we would not have MOOC. The period 2008-2012 has seen a sharp rise of the MOOC and 2012 was seen as the year of the MOOC (Pappano, 2012; Mangan, 2012) and 2013/2014

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has seen much less fervour surrounding the MOOC concept as attrition has come into sharper focus (Martin, 2013) . However, MOOC have established a foothold in the education eco system and it is not possible to ignore their potential contribution to global education particularly in the developing world (Christensen, 2013). MOOC tend to be offered by universities in partnership with providers such as Coursera, and Udacity. According to Hew and Cheung (2014) one of the fastest growing MOOC providers is Coursera which has more than 30 university partners including Princeton, Brown, Columbia, Duke, Stanford, and Johns Hopkins, and has registered 2.8 million students and there are in the region of 1.4 million course enrolments every month.

In order to look at the international drive to promote MOOCs there are a number of issues to address. These include:

- Who is driving the initiatives for MOOC?
- Why this agenda is being promoted?
- How does this agenda manifest itself in national policy and initiatives?

According to Breslow et al (2013) some of the primary reasons why students enrol in MOOC is the desire to learn about a new topic or to extend current knowledge, curiosity about MOOCs, for a personal challenge, and the desire to collect as many certificates as possible. The findings from a survey on *Student Perspective* conducted by Belanger and Thornton (2013), which had some 3,576 respondents, also found that many had enrolled on a MOOC in order to extend their current knowledge. Looking at many of the international initiatives to engage with MOOC it would seem that MOOC may be seen as a "quick fix" to address access to education and acquisition of skills such as problem solving and digital literacy. The European Commission Education and Culture produced a report in 2004 on Innovative Learning Environments in School Education. The findings of this report highlight that the integration of ICT has been identified by key stakeholders as a priority: "there is a strong public involvement in promoting the integration of ICT in learning in the school environment. This means that even where the integration of ICT in schools is not yet underway, it is a major goal which is jointly recognised as representing a priority need among both central and local government politicians, school administrators, school management, teachers, parents and pupils" (European Commission, 2004, p 13). There is a global recognition at government level that there is a need for new literacies and many governments around the world are looking to reform their educational systems to prepare students for the 21st century. Often, these reforms incorporate ICT and attempt to connect education change with economic growth and social development. Leading international figures are calling for educational reform to educate and equip students with the essential skills for a modern world (e.g. Obama, 2009). MOOC in particular are seen as a means to provide students with these skills.

The skills of many workers do not match the demands of the job market and the gap is widening. There are 200 million unemployed people around the world, 75 million of whom are youths, and many lack rudimentary workplace skills - the ability to use a computer, make a budget, communicate in an office environment (Bornstein, 2012). Bornstein cites the 2012 study published by the McKinsey Global Institute which states that by 2020, the world will have a surplus of up to 95 million low-skill workers and a shortage of up to 40 million college graduates. MOOC could potentially assist in closing this gap. In many developing regions of the world mobile devices are the dominant means of accessing the internet (Whitesides, 2013, Ling and Donner, 2013). This would indicate that there is a great potential for MOOC in these regions (Stormquist, 2014). There is also an on-going shift towards ubiquitous learning,

allowing people to access information no matter what device they are using (Cleary and Marcus-Quinn, 2015). However, it could be the learning objects that will be core to the success of MOOC. Outside of the benefits of adopting MOOC in the developing world there are also case studies where MOOC are being incorporated into traditional graduate courses in the developed world. For example, in 2012 Vanderbilt University integrated a MOOC into a graduate course in machine learning during the fall semester (Bruff et al, 2013). The potential for adopting elements of MOOC as part of a complex blended learning solution is significant and as the teaching and learning environment changes to meet the needs for today's learners we will see more of this type of activity (Conole, 2013).

The Emergence of Open Educational Resources (OERs)

In recent years, there has been a large increase in the number of third level courses delivered online. Courses are either delivered completely online or using a blended approach whereby students may receive some coursework online but they may have to attend a limited number of workshops/lectures on campus. This change in delivery has necessitated a change in the type of course materials that learners are given. Developing materials for online delivery is not an easy task and many have had to evaluate their own teaching materials and in some cases have either had to redesign or develop teaching resources that match this new cohort's learning expectations and needs (ref). Digital resources are being developed increasingly to meet these needs (Mohan, Greer and McCalla, 2003).

Kim and Shih (2004) are also among the many educators at third level who believe that one of the greatest challenges for distance learning is the creation of high quality course materials (lecture notes, references, tests, etc). Kim and Shih advocate the sharing and reuse well-developed learning objects to "reduce the load on instructors, and to make them available across a wide variety of platforms" (p 29). International best practice indicates that the successful development of high-quality learning objects is collaborative, that there are sufficient resources available in terms of expertise and money and that the objects can easily be shared.

In 2002 the Massachusetts Institute of Technology (MIT) began an initiative to make available online, without any payment, educational materials from its undergraduate and postgraduate courses. These materials, including learning objects are openly available to anyone. The project is jointly funded by the William and Flora Hewlett Foundation, the Andrew W. Mellon Foundation, and MIT. In terms of its sheer size, comprehensiveness, level of coordination as well as its free global access, this project is now held as an example of best practice for the development and sharing of high quality learning objects. Since 2002 there are more international offerings of this kind including: Khan Academy, Connexions, MERLOT (Multimedia Educational Resource for Learning and Online Teaching) in California, JORUM and JISC in the UK (funded by the UK HE and FE funding bodies[2] to provide world-class leadership in the innovative use of ICT to support education and research." Even smaller countries such as Ireland have a national digital learning repository (NDLR). Repository services such as these encourage educators to design and develop very high quality learning objects and make them available online to the wider teaching community. In addition to storing the learning resources, some of these repository services also provide infrastructure to support subject or discipline based communities of practice in higher education. The spirit of collaboration generated by many of these communities of practice facilitates the development of learning objects with very limited resources.

Many international Open Educational Repositories offer a federated search facility to enable members to search other significant repositories such as JORUM and MERLOT for relevant teaching materials. Such search facilities are probably the closest that we will get to a global repository of learning objects.

POTENTIAL FOR OERs IN MOOC

Following the UN Millennium Summit of 2000 a set of eight Millennium Development Goals (MDGs) were established. In 2000 all 189 United Nations member states (this number now stands at 193 in 2014) and at least 23 international organizations pledged their help in attempting to achieve the MDGs by 2015. Among these eight goals is a proposal to achieve universal primary education "to ensure that by 2015, children everywhere, boys and girls alike will be able to complete a full course of primary schooling" (UN, 2000). Currently it does not look like this target universal primary education will be achieved by 2015. Recent figures state that 120 million children could still be out of school in 2015 and that girls are still behind boys in both school enrollment and attendance (UN, 2005). While it may not be possible to achieve by 2015 the creation of specific learning objects as part of a targeted MOOC initiative could help to achieve the goal of universal primary education within the next decade.

This then begs the question as to what kind of MOOC do we need to facilitate global access to education? To meet this challenge the educational offerings need a MOOC that is open and accessible and this would suggest open learning objects with creative commons at the center of the design and development process. Founded in 2007 ALISON (Advance Learning Interactive Systems Online), based in Ireland, is one of the biggest MOOC providers outside of the US and is cited by many as the first true MOOC. Company founder, Mike Feerick, received an award in 2013 from UNESCO for innovation in online workplace education and has been recognized by Ashoka as a social entrepreneur. Feerick has stated that his vision for ALISON is that the service will offer basic education and training that is freely accessible online worldwide and accessible by everyone. Feerick believes that "Education underpins all social progress. If we can improve the general education level worldwide, global poverty can be dealt with profoundly and a general standard of living can be vastly improved."

ALISON offers over 600 courses in the areas of:

- Business & Enterprise Skills
- Financial & Economic Literacy
- Languages
- Digital Literacy & IT Skills
- Personal Development & Soft Skills
- Diploma Courses
- Health & Safety & Compliance
- Health Literacy
- Health & Safety (Irish Legislation Only)

DESIGN, DEVELOPMENT, AND SUSTAINABILITY OF LEARNING OBJECTS

To make the best possible use of learning objects they need to have clear, achievable learning outcomes that are relevant to the skill they are trying to learn. While much of the literature encourages the development of learning objects, a number of issues remain which impede instructors from deciding to develop them (Gauthier and Ferreira, 2013). These include the following: concern about cost, lack of time, access to expertise and anxiety about the perceived quality of shared learning objects. Concerns about copyright also impede sharing (Marcus-Quinn and McGarr, 2013). Learning objects need to be planned well if they are to last the test of time and not become dated looking. There is little point in developing learning objects with a short lifespan. This is why planning is so important and adhering however loosely to a design model is important. Educators have a range of design and development modes to choose from. Traditionally, many instructional designers have used the ADDIE model to design and develop high quality training materials. The five phases of this model are:

- Analysis,
- Design
- Development,
- Implementation
- Evaluation

Having a development model in place also highlights what resources are available to create the learning object and what must be descoped form the design due to a lack of resources. Many creators of learning objects claim that having limited resources can lead to more focussed planning resulting in a more successful learning object (Marcus-Quinn and Geraghty, 2010). Clarifying the learning outcomes at the very beginning of the process ensures that the object leads to the intended outcomes. This step can be time consuming but it is crucial. Boyle (2003), among others, notes that another way of reducing costs is to identify existing resources that can easily be accessed, in-house recording and design facilities, at no additional cost for instance. Developing successful digital learning objects takes time. However, establishing a clear idea of the learning outcomes will save time in the long run and successful learning objects can have great longevity. Collaboration also saves time because not everyone in the group will need to develop the same level of technical skill.

Usability testing is another key stage in the development process. Nielsen (2010), in his Usability 101, believes that 10% of the overall budget be allocated to usability testing.

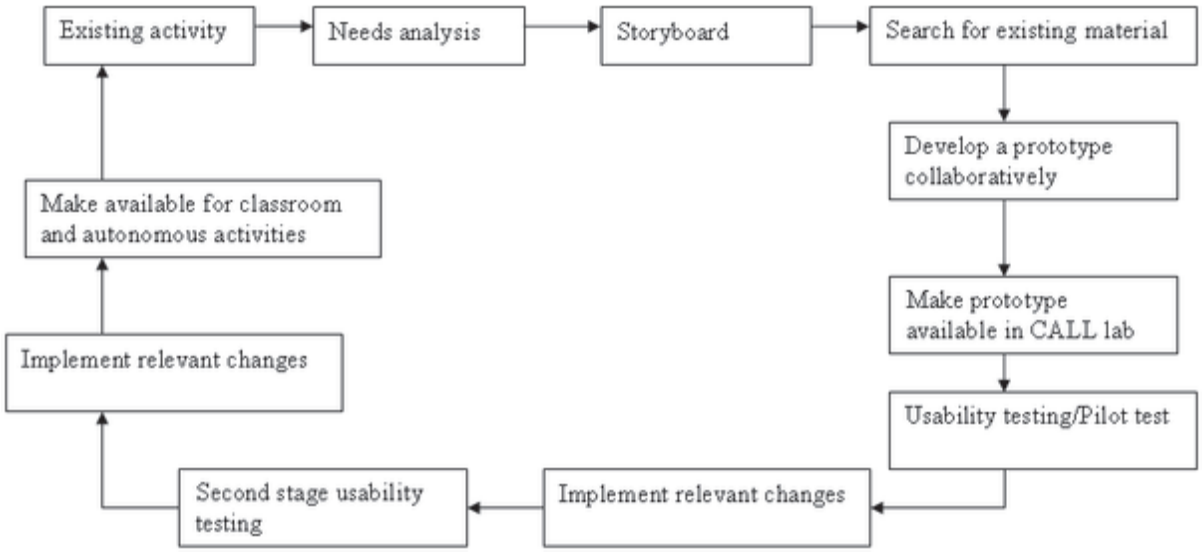
There are many adaptations of this basic development model for learning objects. The next section briefly describes the model used for a successful collaboration between two disciplines – Technical Communication and Japanese – at the University of Limerick leading to the development of a learning object for language teaching.

LONGEVITY OF SUCCESSFUL COLLABORATIVE LEARNING OBJECT DEVELOPMENT

Walter Perry the founding head of the UK Open University believed that the development of courses by teams of academics was a better model than development by individual academics. Similarly, for

a learning object to be successful there is evidence to suggest that there is need for the objects to be collaboratively designed and developed. James Taylor from the University of Southern Queensland Australia advocates "…a multi-disciplinary team approach, wherein a wide range of specialist expertise is applied to the generation of training programs" (Taylor, 2008). Taylor is one voice among the many who believes that the necessary level of expertise for the development of technical teaching and learning systems is usually beyond the skill set of individual teachers and appears to demand the deployment of an expert teaching team, with a wide range of specialist skills. A structured collaborative method of design and development of content is preferential to what Taylor terms "random acts of innovation". These random acts of innovation are the result of individual lecturers spending time and money developing similar learning objects. If they shared their resources, perhaps in a repository, they could see where gaps needed to be filled rather than constantly reinventing the wheel. Over a decade ago in 2004 Geraghty (a Japanese lecturer) and Marcus-Quinn (an instructional designer) designed and developed an OER to teach zero beginners of Japanese how to read and write one of the Japanese writing systems at the University of Limerick, Ireland. The process began with an existing learning activity. The instructor in this case decided to explore the option of digital delivery. They conducted a needs analysis together. The instructor clarified the learning outcomes required. They both searched for existing material that might meet these needs. If it already existed, no further work would have been needed. There was no usable material in existence already so they developed a couple of possible prototypes together and the instructor selected the most appropriate one. These prototypes were not complete learning objects: they gave an idea of what the eventual learning object would look like. Once the most appropriate prototype was selected, it was developed as a full learning object. Initial usability testing was then carried out. On the basis of the findings from this testing, they implement required changes. They then carried out usability testing again with a different group, implemented the additional changes and finally made the learning object available for use by learners.

Figure 1. Model of Design and Development process for hiragana learning object (Marcus-Quinn and Geraghty, 2010)



What emerged from this collaboration was the importance of having a development model. The specific development model chosen is not as important as having a design and development process in place. Awareness of the stages in the process applicable to your project is essential. More than a decade later, in 2014, the OER is still being used (with minor modifications) at the University of Limerick and a second successful learning object to teach the Katakana has also been developed and rolled out to students. A third object is currently being developed to teach the Kanji. The success of the first learning object can be attributed to the collaborative nature of its development and the commitment to a focussed learning outcome from the beginning: students would learn to recognise pronunciation and associate that sound with the correct character. Ten years later, in 2014, feedback from learners remains positive and the learning object is still in use. This positive experience is in line with how successful learning objects are developed by many faculty members at third level (Mei and Boyle, 2010).

THE EFFECT OF SUBJECT DISCIPLINE ON THE SUCCESS OF MOOC

Another significant question to emerge as more people engage with MOOC is the under representation of the Arts and Humanities in the available MOOC. This raises the question "does the nature of the discipline increase/reduce the reusable nature of the objects and consequently the MOOC?" Sir John Daniel recently discussed the Arts and Humanities under representation in MOOC at a seminar in Paris in June 2014. A delegate at the seminar remarked that if somebody wanted to take a MOOC in French history through English there was only one offering; a course from Princeton University. However, it would seem that the learning objects provided by Princeton placed Robespierre in the same company as Hitler and Stalin which is probably not where a French historian may place him. The cultural context of learning objects plays a significant role in how the resources are designed and in how the content is presented. In a small scale study by Marcus-Quinn and McGarr (2013) a learning object was designed to teach English poetry to Irish students. The English curriculum in an Irish post-primary school is quite different from the English curriculum offered to students undertaking English at a secondary school in the UK or even at high school in America. While some international material may be covered the poetry and prose tend to be largely culture specific. This small study observed the use of learning objects in three different schools and the findings highlighted that even with such a small sample how the learning object was used differed greatly between schools. The curriculum specific literature will differ greatly while the activities surrounding the literature may be very similar. In contrast to this a learning object created for mathematics may be far more reusable. It may not need to be localised and may not have any culture specific information that would have to be removed before the object could be reused in another country. Therefore, such an object would be highly reusable. Learning objects developed for scientific subjects where core course material is universally accepted are highly reusable. Scientific formulae do not need to be translated.

If we look at Table1, Becher's classification of academic disciplines (Becher, 1989), the type of information categories are divided into hard and soft knowledge and pure knowledge and applied knowledge. This corresponds with the earlier framework for the representation of the reusability of learning objects in the classroom. The following figure is a synthesis of the concepts surrounding Learning objects that are prevalent in both Boyle's work and Becher's model. This new model illustrates learning objects in-

Table 1. Becher (1989)

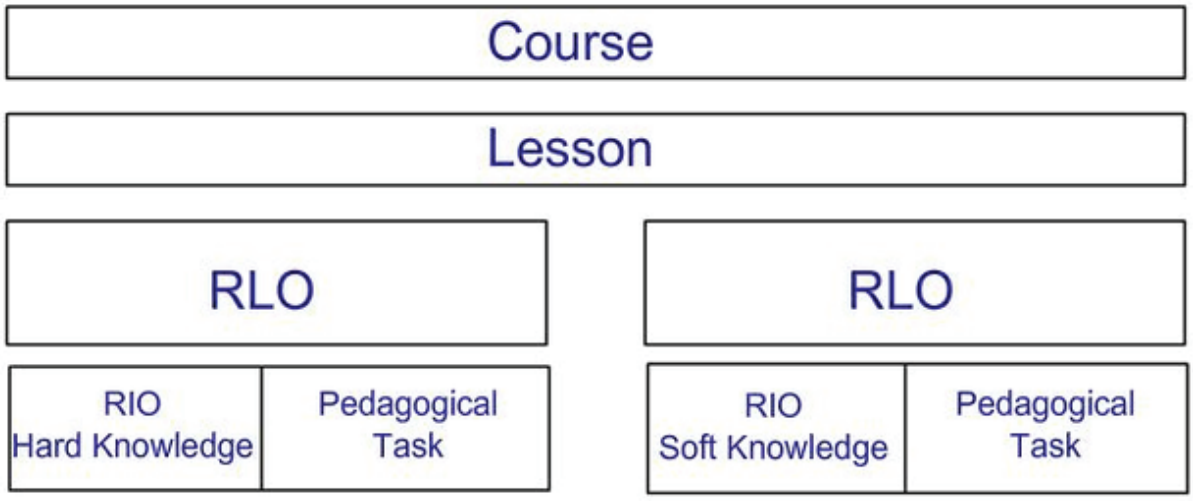
	Hard Knowledge	Soft Knowledge
Pure Knowledge	**e.g. Chemistry, Physics etc** • Discovery of the 'new' • Analysing specific elements of a problem • Finding universal truths • Explanations are strong • Research is value free	**e.g. Sociology, Political Science** • Re-examining ideas within different theoretical contexts • Synthesis, focus on complexity of inter-linkages • Finding patterns which fit particular contexts • Explanations are weak, due to the multiple 'causes' and 'effects' • Research is value laden as it deals with human subjects
Applied Knowledge	**e.g. Engineering, Medicine** Draws on hard pure knowledge but differs in the following respects: • Use of trial (and error) as methodology • Focused on addressing problems, rather than 'discovering' truths • May be many solutions to problem (rather than one truth) • Effectiveness rather than 'discovered truth' is criteria of judgement	**e.g. Education Studies, Social Policy** Draws on soft pure knowledge but differs in the following respects: • Knowledge is less stable than hard applied knowledge, and has less of a sense of progression as 'answers' become critically re-evaluated. • Trial (and error) are commonly used as methodologies • May be many solutions • Pragmatic utility is criteria of judgement

tegrated into the top levels of instruction and delivery: course and lesson. This model sees two distinctly different types of learning object emerging; learning objects that are predominantly content-based and those that are activity/task-based where the pedagogical task is independent of the actual information.

MIT's open courseware provides a case in point. The Open courseware initiative is a web based publication of MIT course content. The material is freely available without any cost to users and does not require registration. MIT recognises that the development of such material is prohibitively expensive for many institutions and so has made the content

Published online is a list of the most visited courses based on monthly Internet traffic. The type and category of most visited course materials tends not to change. The most visited learning materials

Figure 2. Synthesis of Boyle's and Becher's models



based on August 2010 site traffic included: Computer science, classical mechanics, calculus, algebra, electricity and magnetism and biology. Four years later the most visited course based on March 2014 site traffic included Computer science, classical mechanics, calculus, algebra, electricity and magnetism and psychology. These subjects fall into the "pure knowledge" category. Language and culture have the least impact on the reuse of such resources. It would seem that some disciplines will make for more successful MOOC than others.

CHALLENGES FOR MOOC

In spite of the recognised growth and spread of the MOOC there are barriers to adoption (Guthrie, 2012) and the MOOC may not be as disruptive to the traditional model as it was initially contemplated (Kolovich, 2013). The challenges for both educators and learners alike include building engagement for MOOC students (Nawrot and Doucet, 2014), the sense of isolation that many students experience when participating in a MOOC and the lack of time for learning that many participants report.

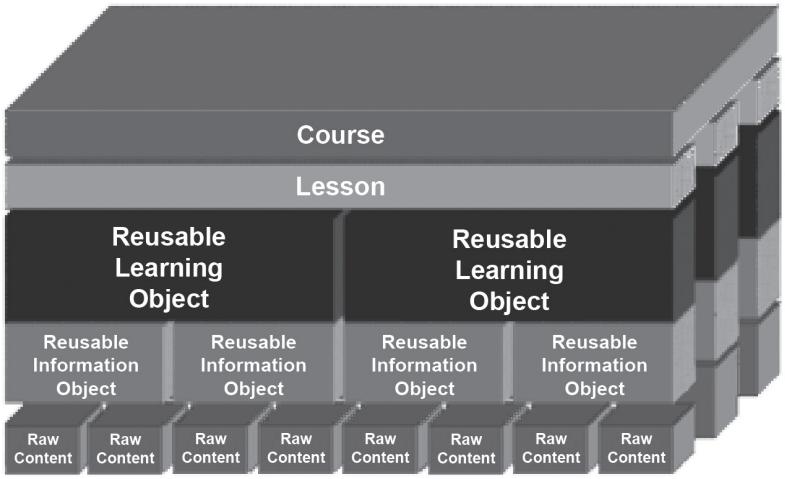
As many as 90% of MOOC participants drop out due to reasons including "a lack of incentive, failure to understand the content material and having no one to turn to for help, and having other priorities to fulfil" (Hew and Cheung, 2014). Interestingly, even MOOC structured around mobile learning can suffer a high drop-out rate. For example, the experience of MobiMOOC was that only 13.3% of 536 participants completed the course as active participants. Some 86.7% were either lurkers or dropped out of the course (Koutropoulos et al, 2012). Other reasons often cited for high drop-out rates include a mismatch between the learner expectation and the reality of the course (Young, 2013). Language of the MOOC can also be seen as an on-going challenge as many MOOC are available through English yet there are languages with little offerings. For example, despite the enormous potential audience for MOOC in China the review of MOOC carried out by Chai and Lang (2014) note that lack of available MOOC for China. Assessment is likely to continue to be problematic for both institutions and learners. Graphical design and interactivity should as button pressing should not be confused with real assessment (JISC Netskills, 2012). However, some of the content challenges can be diminished with awareness and implementation of good practice at all levels of design, development and delivery of a MOOC.

GOOD PRACTICES WITH LEARNING OBJECTS WITHIN MOOC

Management of Reuse of Learning Objects for MOOC

Before the advent of the MOOC corporate training was one of the early courses to be delivered online. Recognising that such training is expensive many of the larger corporations included learning objects in the training materials. The use of learning objects enables material to be modified and repurposed at a lower cost. Chyung (2007) in writing about the flexibility of learning objects refers to the use that some large corporations such as Autodesk Inc. and Cisco Systems have made of such resources. In recognising that there are different levels of learning objects material becomes more relevant, reusable and more cost effective. Granular objects also seem to be more successful. Boyle (2003, 2005) cites the model that Autodesk use to illustrate the different levels at which design for learning can be focused.

Figure 3. Autodesk's model for content analysis as described by Boyle (2010)



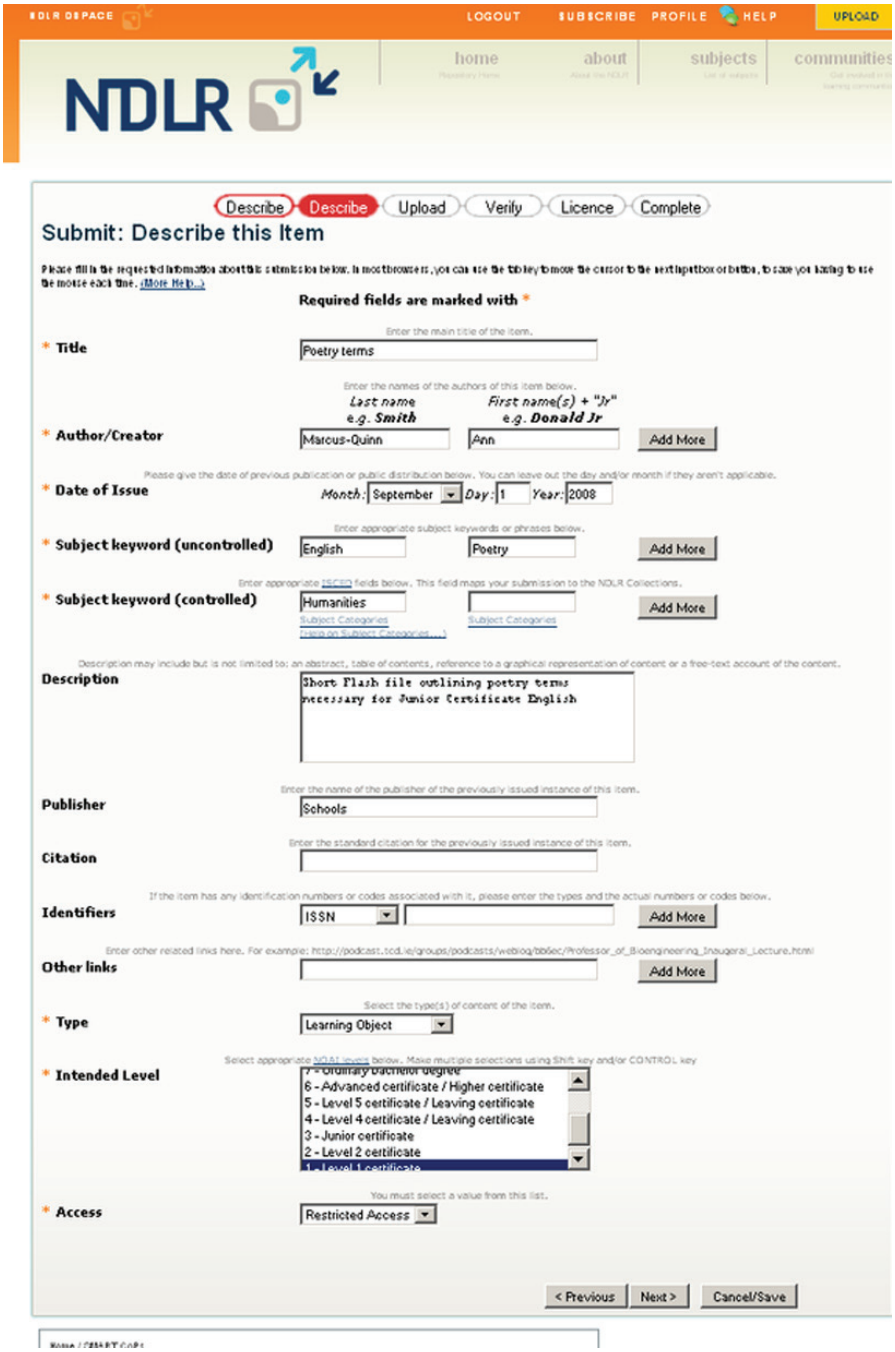
This content analysis model illustrates the granularity principle applied to Learning objects. If a learning object comprises a number of smaller objects which can be decoupled (Boyle and Cook, 2001), it is possible to gather, group together and separate chunks of learning content in a variety of different ways, as required by the teacher at a given time. The design guidelines provided by Cisco to design and develop Learning objects is relevant if the time and expense invested in creating Learning objects is to be capitalised on. Perhaps if the assessment components of learning objects for schools were stored separately as activity learning objects this would render the original learning resource more reusable. Nelson (1997) suggests that teachers break learning resources down into the various parts before reassembling them in their preferred manner for use in the classroom. Boyle and Cooke (2001) in their work on learning objects address the question of identifying the "basic unit of reuse" (p31). Boyle and Cooke cite Polsani's (2003) definition of a learning object as: "an independent and self-standing unit of learning content that is predisposed to reuse in multiple educational contexts". Boyle and Cooke have proposed a cohesion and decoupling model for the creation of learning objects. This good practice could be incorporated into the design of learning objects for MOOC.

Open Licensing

There is no question that high quality learning objects enhance the learning experience. Therefore how these resources are managed is critical. Best practice would see learning objects made available through the open creative commons license. In June 2012 during the world congress that UNESCO convened in Paris a declaration on OERs was drafted and presented to a global audience. Sir John Daniel stated that OER have great potential for reducing the cost of expanding quality education. It was hoped that through the declaration governments would commit to promoting OERs and the open licensing of educational materials "It is hoped that after the Paris congress that governments will adopt a declaration urging that educational materials produced with public funds be made available under open licenses. Government

backing for open licensing is essential if we are to make OERs the normal way of doing business instead of a donor dependent phenomenon" (Daniel, 2012). This joint UNESCO/ Commonwealth Of Learning project continues to aim to bring OER into the mainstream of education and there is an on-going and open invitation for governments' support.

Figure 4. Metadata fields for resources uploaded to the NDLR



Metadata

As has been discussed developing resources is a costly and time consuming process. It therefore makes sense to render resources as accessible and easy to locate (Green et al, 2013). In addition to making the actual learning object as reusable as possible the management of reuse must also be considered. Therefore, the descriptive data associated with the learning object (metadata) should be as accessible as possible to facilitate the discovery and retrieval process of obtaining learning objects (Barak and Ziv, 2013). If educators are encouraged to share their learning materials, whether or not they are the authors of the material, the process of locating and accessing the files needs to be managed. Making the metadata as detailed as possible also allows for the learning object to be accessed by a much wider community.

Metadata is used to facilitate the understanding, use and management of learning resources. Metadata is information which describes each learning resource in the repository. Figure 4 illustrates the metadata fields associated with a resource that has been uploaded to the Irish National Digital Learning Repository (NDLR). The agreed metadata stored for objects in the NDLR includes general information, language of the resource, author, and role of author, date of publication, rights and conditions. This metadata is typically stored as an XML file. In the case of many international repositories it is recognised that developing a regular set of metadata standards facilitates more effective search and retrieval of learning objects. One example of such a practice is where the NCTE participated in the EU Metadata projects where it worked with 13 European ministries of education to develop a fixed set of metadata standards and WEB 2.0 systems for sharing educational content between teachers and learners across Europe.

CONCLUSION

Technology is changing how education is designed, developed and delivered. There is a critical need to investigate the potential impact of these changes. This chapter has looked at the emergence of Open Educational Resources and the crucial role that a formal design and development models play in creating high quality learning objects. The chapter has also highlighted the central role that high quality learning objects play in MOOC.

MOOC have attracted enormous attention over recent years and developments have been closely related to the exponential availability of mobile devices. As the drive to provide access to education for all has become a global conversation the need for high quality learning objects in MOOC is critical. Consequently, it is now evident that if learning objects are being created through the availability of public funding they should be created in the most open manner. We need a framework of standards for the creation of high quality learning objects in order to create the best possible MOOC for today's learners.

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